Combined Radiofrequency Ablation and Augmentation for the Palliation of Vertebral Metastases: Case Examples and Review.

Christian Sleeper, BA\textsuperscript{a,b}, Matthew Moccia, DO\textsuperscript{c}, Joseph Gerding, MD\textsuperscript{b} and Ethan Dobrow, MD\textsuperscript{d}

\textsuperscript{a} Tufts University School of Medicine, Boston, MA; \textsuperscript{b} Maine Medical Center, Portland, Maine; \textsuperscript{c} Veterans Affairs Maine Healthcare System, Augusta, Maine

Purpose:

This exhibit will review radiofrequency ablation (RFA) and percutaneous vertebroplasty (PVA) in the palliative treatment of painful spinal metastases through a series of case examples. We will also review the current literature supporting the use of these combined therapeutic modalities, in particular the choice of RFA as the ablative modality for spinal lesions.

Methods:

A total of four patients with symptomatic vertebral metastatic lesions underwent kyphoplasty with concomitant radiofrequency ablation at a single tertiary care center. Under fluoroscopic guidance, trocars were advanced into the vertebral body via a transpedicular approach in the lumbar spine or an extrapedicular approach in the thoracic spine. Once appropriately positioned, radiofrequency ablation probes were inserted into the trocars and activated. Ablation times varied between 6 and 15 minutes depending on size of the probe used. Upon ablation completion, kyphoplasty balloons were inflated and cement was injected within the vertebral body. Finally, polymethylmethacrylate cement was prepared and inserted into the trocars to fill the vertebral body and complete the procedure.

Introduction:

Bone represents the third most frequent site of solid tumor metastasis, with breast, prostate, lung, thyroid, and kidney primaries being implicated in 80 percent of cases\textsuperscript{1}. The vertebral bodies are the most susceptible to metastatic spread, with an estimated 30 to 70 percent of oncology patients developing vertebral metastasis during their disease course\textsuperscript{1}. The presence of vertebral metastatic disease is associated with significant morbidity including pain, fracture, hypercalcemia, and spinal cord damage. It has been reported that up to 80 percent of patients will experience severe pain before palliative treatment is initiated\textsuperscript{2}. Traditional management has often utilized a multidisciplinary approach, with external beam radiation being the gold standard for palliative management\textsuperscript{3-5}. NSAIDs, opioids, bisphosphonates, and radiotherapeutics are also used for supplemental therapy and pain control. Despite these measures, patients often experience refractory pain and significantly reduced quality of life\textsuperscript{6}. In these patients, both vertebral augmentation and local ablation therapies have been discussed in the literature as potential therapeutic options\textsuperscript{7,8}. Although a variety of ablative methods have been discussed within the literature, bipolar RFA is our preferred modality due to the reported insulating effects of cortical bone and decreased heat transmission through cancellous bone\textsuperscript{9,10}. In patients whose vertebral cortex is intact, ablation zones are therefore less likely to extend beyond the cortex and damage surrounding neural structures. More recently, emerging data has shown that concomitant use of radiofrequency ablation (RFA) and percutaneous vertebroplasty (PVA) may play an important role in management of refractory vertebral metastases by providing both pain palliation and local tumor control\textsuperscript{11-15}. In this presentation, we describe a procedural technique for RFA-PVA and as well as review four patient cases who successfully underwent management for refractory metastatic disease.

Case #1 - Metastatic Renal Cell Carcinoma

A 61 y/o male with metastatic renal cell carcinoma presents with upper back pain. CT revealed complete replacement of T5 with a lytic metastasis. He underwent combined RFA and PVA. Follow-up CT revealed excellent cement fill in the T5 vertebral body without cement extravasation.

Case #2 - Metastatic Breast Cancer

A 66 y/o female with newly diagnosed primary breast cancer presents with worsening low back pain. A CT revealed multiple lytic lesions throughout the lumbar spine. A contrast enhanced MRI demonstrated pathologic compression fractures of L1 and L5. Using bi-peculiar technique, combination RFA and PVA was performed. Following the procedure, the patient reported reduction in her lower back pain. Subsequent imaging revealed excellent cement fill in the L1 and L5 vertebral bodies.

Case #3 - Metastatic Gastric Cancer

A 43 y/o male with a history of gastric adenocarcinoma presents with pain secondary to multiple PET and spinal metastases involving the T3-T5 vertebral bodies. Combined RFA and PVA was performed utilizing a bilateral extrapedicular technique at all levels. Follow-up PET-CT revealed excellent cement fill and absent FDG uptake at the treated levels.

Case #4 - Metastatic Renal Cell Carcinoma

A 50 y/o male with primary renal cell carcinoma presents with an isolated, asymmetric L5 spinal metastasis with associated pathologic fracture. He subsequently underwent unipedicular RFA and PVA. Follow-up CT revealed cement filling the entirety of the asymmetric lytic lesion with minimal cement egress through the disrupted lateral cortex.

Conclusions:

This method appears to be a safe and technically feasible approach for the management of painful osseous metastases. All four patients underwent technically successful vertebral augmentation with radiofrequency ablation. This approach may be applied in the management of painful vertebral metastases with concomitant radiofrequency ablation.

Citations:


Preprocedural imaging: A: Sagittal CT demonstrates effusive lytic and soft tissue tumor. B: Sagittal T2WI and T1WI more clearly demonstrate pathologic compression deformities of L1 and L5 (red arrows).

Preprocedural image: A: Sagittal CT demonstrates effusive lytic and soft tissue tumor. B: Sagittal T2WI and T1WI more clearly demonstrate pathologic compression deformities of L1 and L5 (red arrows).

Preprocedural image: A: Sagittal CT demonstrates effusive lytic and soft tissue tumor. B: Sagittal T2WI and T1WI more clearly demonstrate pathologic compression deformities of L1 and L5 (red arrows).

Preprocedural image: A: Sagittal CT demonstrates effusive lytic and soft tissue tumor. B: Sagittal T2WI and T1WI more clearly demonstrate pathologic compression deformities of L1 and L5 (red arrows).